

CHEM 3510 – Physical Chemistry I

Fall 2026

Instructor

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 - [Chemistry Resource Center \(CRC\) office hours \(link\)](#)

Course Readings

- Main reference (MIT OpenCourseWare):
<https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/index.htm>
- For a more detailed reading: “*Atkins’ Physical Chemistry*” by Atkins, de Paula, (and Keeler). The chapter references are based on the 8th edition, but other editions should also work.
- Other recommended reading (Chem LibreTexts):
[https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Thermodynamics](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics)
- Lecture materials will be posted on Canvas

Lectures (Section: 001)

- Time: 10:10 am – 11:00 am, Mon./Wed./Fri.
- Location: Room 352, Chemistry Building.

Recitations (Section: 201, Optional)

- Time: 1:25 pm – 2:15 pm, Wed.
- Location: Room 352, Chemistry Building.

Office Hours

- Time:
 - 1:00 pm – 3:00 pm (excluding recitation time), Wed.
 - On-demand appointments
- Location: Room 205A, Chemistry Building (or Zoom if requested in advance).

Course Description and Objectives

Physical Chemistry I (CHEM 3510) is part of a two-course series that aims to teach students the physical principles for understanding chemistry. The focus of this course is Thermodynamics and kinetic theory, which are necessary to describe the behavior of chemical equilibrium and reaction kinetics. The core skill of this course is the physical and mathematical approach to chemistry problems.

Although brief reminders will be provided, this course assumes familiarity with calculus.

By completing this course, we expect students to develop a basic understanding of:

- States of matter and the transitions between them
- Laws of thermodynamics
- State functions and their relationships
- Chemical equilibrium
- Chemical kinetics
- Applying physics and mathematics to chemistry problems

Course Outline

In this course, we plan to cover the following tentative topics and schedule (which are subject to change):

Date	Subject	Materials
8/17	Lecture 1: Introduction and Overview	Lec-01.pdf
8/19	Lecture 2: State of a System, 0th law, Equation of State	Lec-02.pdf
8/19	Recitation 1: Mathematical Background	Recitation-01.pdf
8/21	Lecture 3: 0th Law, Equation of State, and 1st Law	Lec-03.pdf
8/24	Mock Biweekly Exam (Range: Math Reminder)	Exam and Solution

8/26	Lecture 4: 1st Law, Internal Energy & Expansion Work	Lec-04.pdf
8/26	Recitation 2: 0th Law, Derivatives, Work, and Heat	Recitation-02.pdf
8/28	Lecture 5: Internal Energy and Joule Free Expansion	Lec-05.pdf
8/31	Lecture 6: Internal Energy and Enthalpy	Lec-06.pdf
9/2	Lecture 7: Thermochemistry	
9/2	Recitation 3	
9/4	Lecture 8: Calorimetry	
9/7	Labor Day (No Class)	
9/9	Biweekly Exam 1 (Range: materials taught between 08/17 and 09/02)	
9/9	Recitation 4	
9/11	Lecture 9: Second law	
9/14	Lecture 10: Entropy and the Clausius inequality	
9/16	Lecture 11: Entropy and irreversibility	
9/16	Recitation 5	
9/18	Lecture 12: Fundamental equation, absolute S, third law	
9/21	Lecture 13: Criteria for spontaneous change	
9/23	Lecture 14: Gibbs free energy	
9/23	Recitation 6	
9/25	Biweekly Exam 2 (Range: materials taught between 09/02 and 09/18)	
9/28	Lecture 15: Multicomponent systems, chemical potential	
9/30	Lecture 16: Chemical equilibrium	
9/30	Recitation 7	
10/2	Lecture 17: Temperature, pressure and K _p	
10/5	Lecture 18: Equilibrium: application to drug design	
10/7	Lecture 19: Phase equilibria — one component	
10/7	Recitation 8	
10/9	Biweekly Exam 3 (Range: materials taught between 09/18 and 10/02)	
10/12	Lecture 20: Clausius-Clapeyron equation	
10/14	Lecture 21: Phase equilibria — two components	
10/14	Recitation 9	

10/16	Lecture 22: Ideal solutions	
10/19	Lecture 23: Non-ideal solutions	
10/21	Lecture 24: Colligative properties	
10/21	Recitation 10	
10/23	Lecture 25: Introduction to statistical mechanics	
10/26	Biweekly Exam 4 (Range: materials taught between 10/02 and 10/19)	
10/28	Lecture 26: Partition function (q) — large N limit	
10/28	Recitation 11	
10/30	Lecture 27: Partition function (Q) — many particles	
11/2	Lecture 28: Statistical mechanics and discrete energy levels	
11/4	Lecture 29: [P. Chem. and Computers] Using NIST Thermodynamic Database	
11/4	Recitation 12	
11/6	Lecture 30: [P. Chem. and Computers] AI-Programing to access NIST dataset	
11/9	Lecture 31: Model systems	
11/11	Lecture 32: Applications: chemical and phase equilibria	
11/11	Recitation 13	
11/13	Biweekly Exam 5 (Range: materials taught between 10/19 and 11/06)	
11/16	Lecture 33: Introduction to reaction kinetics	
11/18	Lecture 34: Complex reactions and mechanisms	
11/18	Recitation 14	
11/20	Lecture 35: Steady-state and equilibrium approximations	
11/23	Lecture 36: Chain reactions	
11/25	Lecture 37: Temperature dependence, E_a , catalysis	
11/25	Recitation 15	
11/27	Fall break	
11/30	Optional Make-up Exam (Range: all materials)	
12/2	Pre-Final Day: Final Review	
12/2	Recitation 16: Additional Q&A	
12/4	UNT Reading Day (No Classes)	

12/9	Final Exam (Range: all materials)	
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Course Grading

- Attendance 10%
- Biweekly Exams 60%
- Final Exam 30%
- Participation in SPOT evaluation: 5% (extra credit)

Notes:

- Grading scale: A = 90-100; B = 80-89; C = 70-79; D = 60-69.

Attendance

Research has shown that students who attend classes are more likely to be successful. You should attend every class unless you have a university-excused absence, such as active military service, a religious holy day, or an official university function, as stated in the Student Attendance and Authorized Absences Policy (PDF) (<https://policy.unt.edu/policy/06-039>). If you cannot attend a class due to an emergency, please let me know via email (hsin-yu.ko@unt.edu) beforehand. Your safety and well-being are important to me.

- Attendance will be taken during some of the lectures via ungraded quizzes.
- Excused absences (e.g., due to health or religious reasons) need to be requested via email (hsin-yu.ko@unt.edu) beforehand and will be approved on a case-by-case basis.

Biweekly Exams

- The scope of the exams will focus on lecture materials and practice problem sets.
- The range of the exam will focus on the recently taught materials that have not been covered in previous biweekly exams.
- Exams will be in person during assigned lecture sessions.
- The best four biweekly exam grades will be averaged for grade purposes.
- Any student caught cheating will receive a grade of zero on that exam. **Zero grades resulting from cheating cannot be dropped.**

Final Exam

- Final exam covers the materials covered for the entire course.
- Exams will be in person following the schedule detailed per UNT policy (<https://registrar.unt.edu/exams/final-exam-schedule/fall.html>).
- Any student caught cheating will receive a grade of zero on that exam.

Examination Policy

The exams will take place in person and should be completed within the duration of the lecture section (50 minutes) unless otherwise approved. Students must answer the questions independently. Communication among students during the exams regarding the materials is considered a breach of academic ethics codes and strictly prohibited.

Makeup Option for Exams for University-Excused Reasons

The available exam grades will be used proportionally. For example, if a student only has biweekly exam score, the average of the three will be used as the outcome to the biweekly exam. If the student missed the final exam, the average of all six biweekly exams will be used instead.

Additional Information

ADA Statement

The University of North Texas makes reasonable accommodations for students with disabilities. To request accommodations, you must first register with the Office of Disability Access (ODA) by completing an application for services and providing documentation to verify your eligibility each semester. Once your eligibility is confirmed, you may request your letter of accommodation. ODA will then email your faculty a letter of reasonable accommodation, initiating a private discussion about your specific needs in the course. You can request accommodations at any time, but it's important to provide ODA notice to your faculty as early as possible in the semester to avoid delays in implementation. Keep in mind that you must obtain a new letter of accommodation for each semester and meet with each faculty member before accommodations can be implemented in each class. You are strongly encouraged to meet with faculty regarding your accommodations during office hours or by appointment. Faculty have the authority to ask you to discuss your letter during their designated office hours to protect your privacy. For more information and to access resources that can support your needs, refer to the [Office of Disability Access](https://studentaffairs.unt.edu/office-disability-access) website (<https://studentaffairs.unt.edu/office-disability-access>).

Communication Practices

Connect with me through email and/or by attending office hours. During busy times, my inbox becomes rather full, so if you contact me and do not receive a response within two business days, please send a follow-up email. A gentle nudge is always appreciated.

Academic Success Resources

UNT strives to offer a high-quality education in a supportive environment where you can learn, grow, and thrive. As a faculty member, I am committed to supporting you, and I want to remind you that UNT offers a range of mental health and wellness services to help maintain balance and well-being. Utilizing these resources is a proactive way to support your academic and personal success. To explore campus resources designed to support you, check out mental health services (<https://clear.unt.edu/student-support-services-policies>), visit unt.edu/success, and explore unt.edu/wellness. To get all your enrollment and student financial-related questions answered, go to scrappysays.unt.edu.

Inclusive Learning Environment

I value the many perspectives students bring to our campus. Please work with me to create a classroom culture of open communication, mutual respect, and belonging. All discussions should be respectful and civil. Although disagreements and debates are encouraged, personal attacks are unacceptable. Together, we can ensure a safe and welcoming classroom for all. If you ever feel like this is not the case, please stop by my office and let me know. We are all learning together.

Emergency Notification & Procedures

UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Canvas for contingency plans for covering course materials.

Retention of Student Records

Student records pertaining to this course are maintained in a secure location by the instructor of record. All records, such as exams, answer sheets (with keys), and written papers submitted during the duration of the course, are kept for at least one calendar year after course completion. Coursework completed via the Canvas online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about students' records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Academic Integrity Policy

According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. The following behaviors are considered academic dishonesty in this class:

- Plagiarism
- Talking to or looking at another person's exam, and/or using unauthorized materials during the quiz
- Having another person complete and submit work in your name
- Lying to an instructor to improve your grade
- Altering a graded work after it has been returned and then submitting the work for re-grading

Such behaviors will result in zero point for the particular assignment or quiz. Additionally, the incident will be reported to the Dean of Students, who may impose further penalty.

Access to Information - Eagle Connect

Students' access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail: eagleconnect.unt.edu/

Student Evaluation Administration Dates

Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The survey will be made available during weeks 13, 14 and 15 of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website at <http://spot.unt.edu/> or email spot@unt.edu.

Unauthorized Aids During Examinations and Assessments

Students may use only those materials and resources that are expressly authorized by the instructor for a particular examination or assessment. Touching, holding, or accessing any unauthorized aid during the examination period constitutes a violation of the Student Code of Conduct, regardless of whether the aid is used.

Any item that may be considered an unauthorized aid must be kept out of view and in a closed container (e.g., zipped backpack, buttoned purse, etc.) during the entirety of the examination or assessment.

Unless specifically authorized in writing by the instructor, prohibited aids include, but are not limited to:

- Mobile phones and smartphones
- Smartwatches and fitness trackers with communication, recording, or internet capabilities
- Tablets, laptops, and other computing devices
- Earbuds, headphones, and other audio devices
- Smart glasses, cameras, recording devices, and wearable technology
- Artificial intelligence (AI) tools, chatbots, and other generative AI technologies
- Notes, textbooks, study guides, formula sheets, or reference materials
- Any other device, material, or resource not expressly permitted by the instructor

Students are responsible for clarifying any questions about permitted materials before the examination begins.